The Distribution of Las Vegas Wash Water in Las Vegas Bay Following a Storm Event

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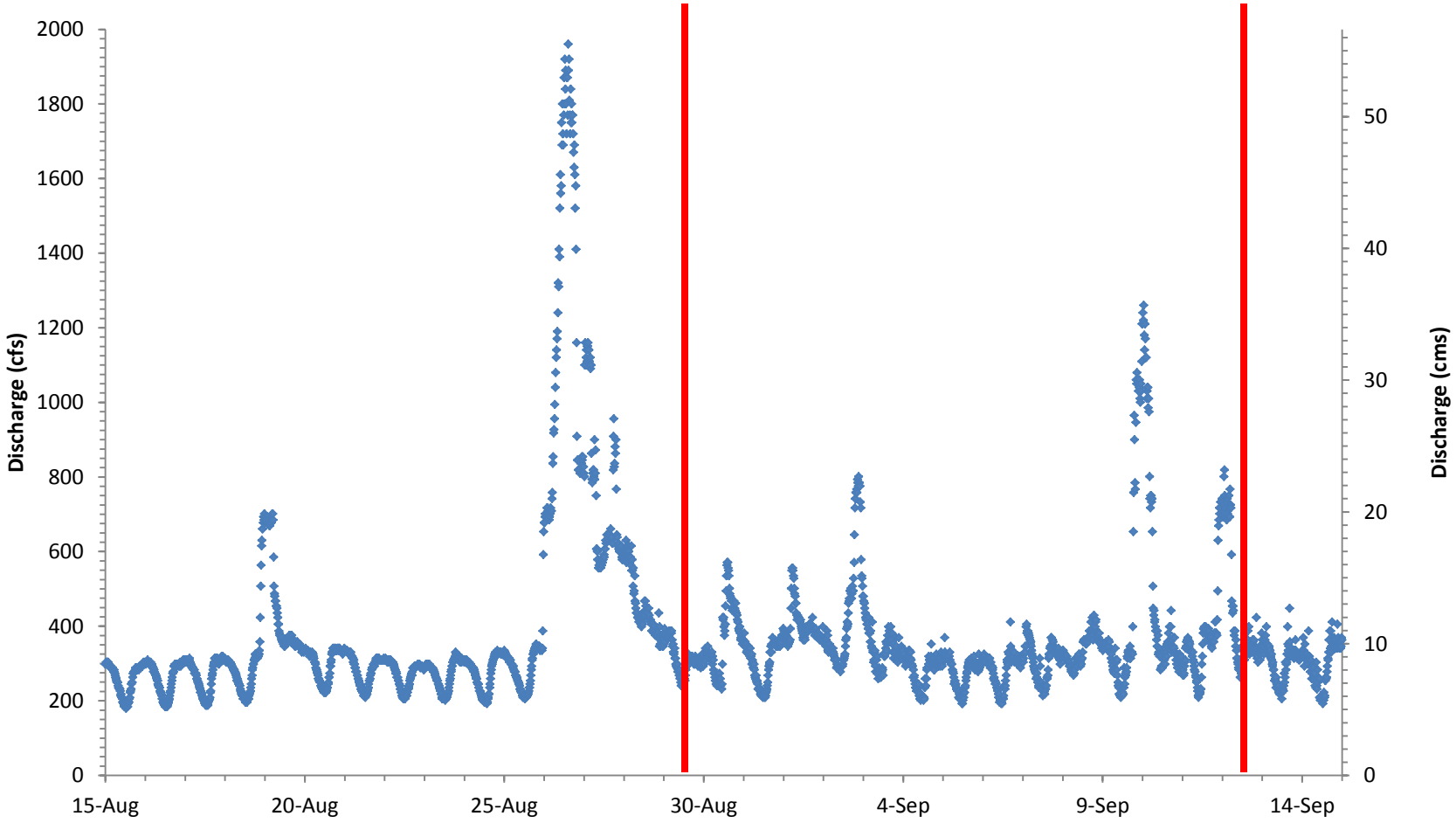
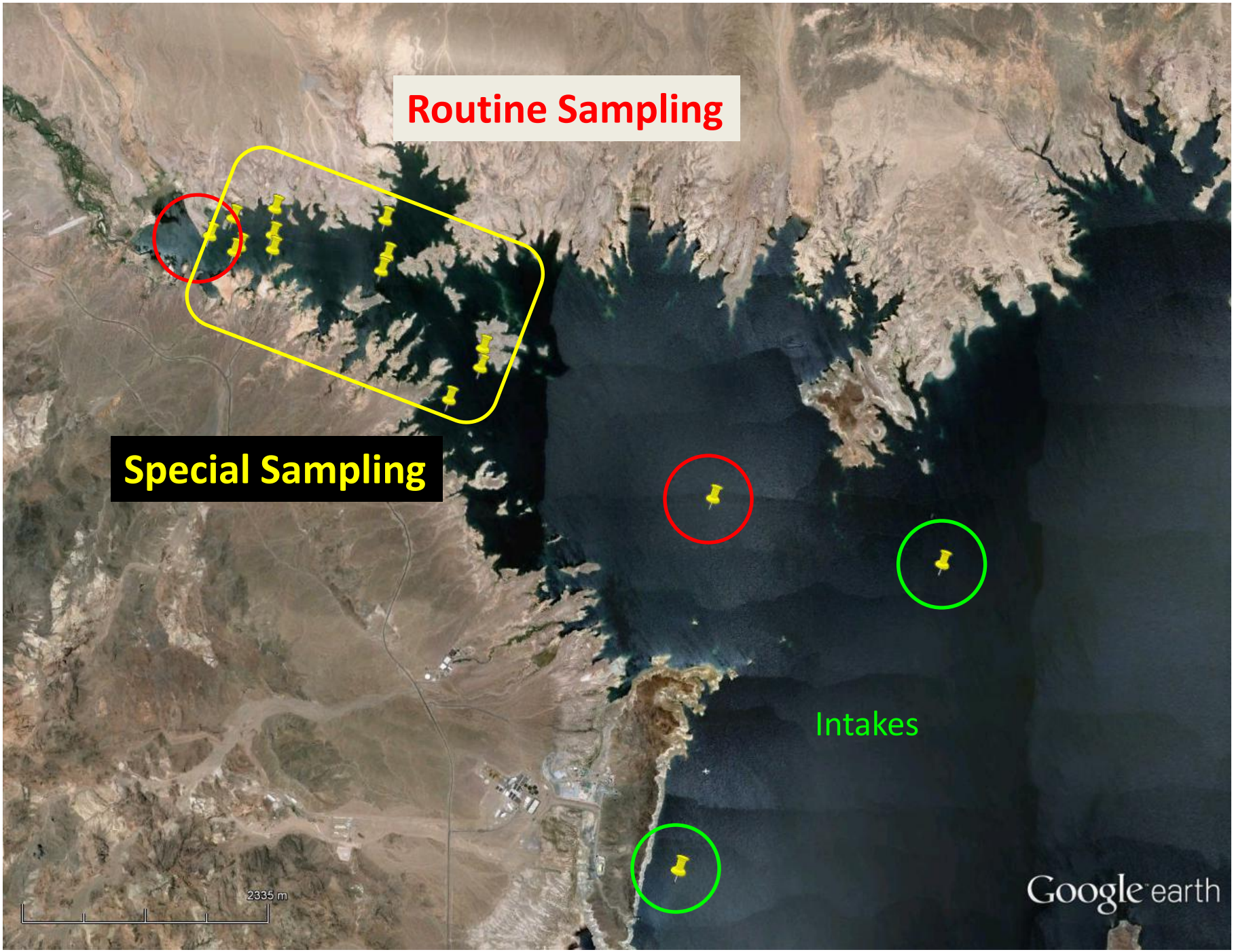
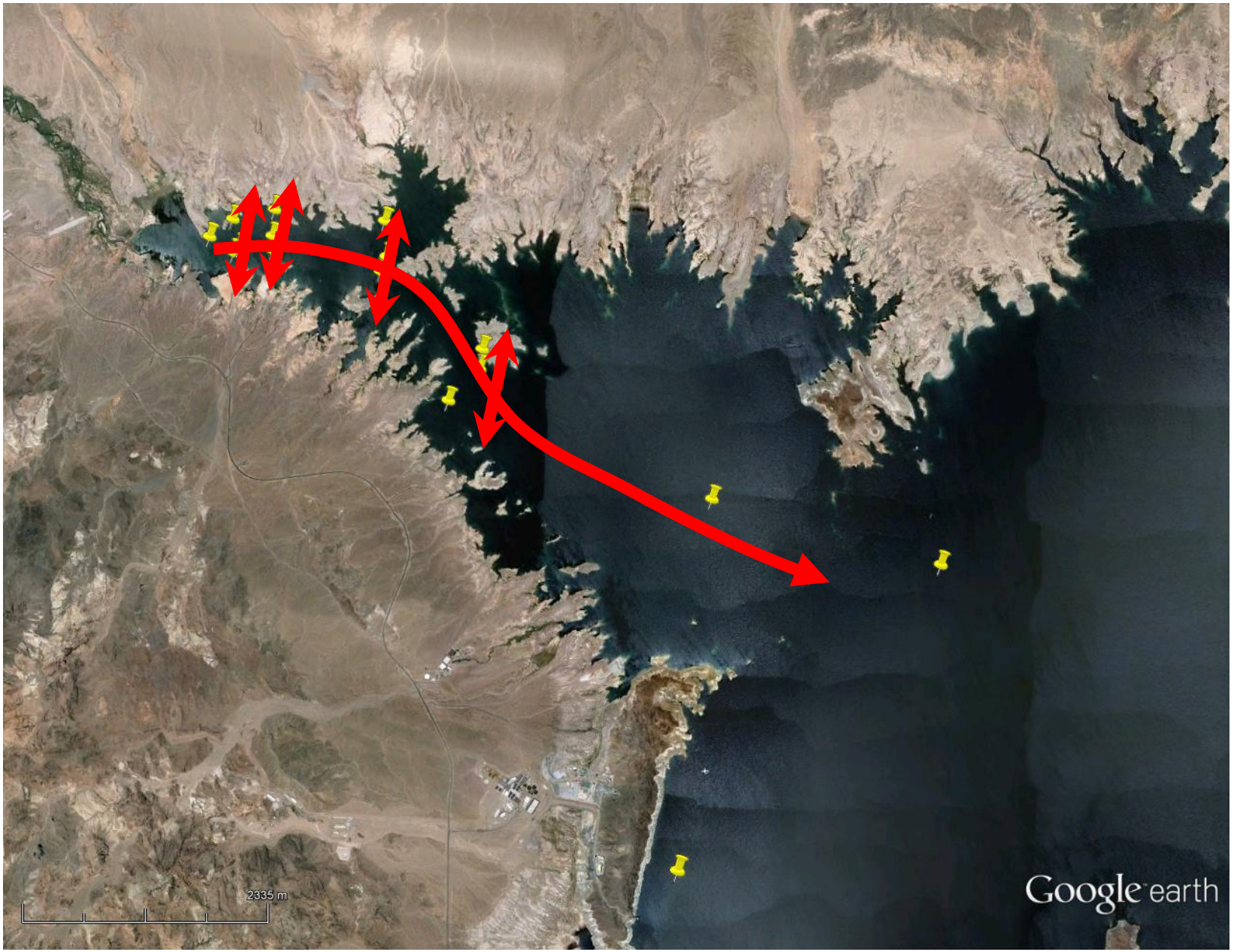
Monsoon Hydrograph

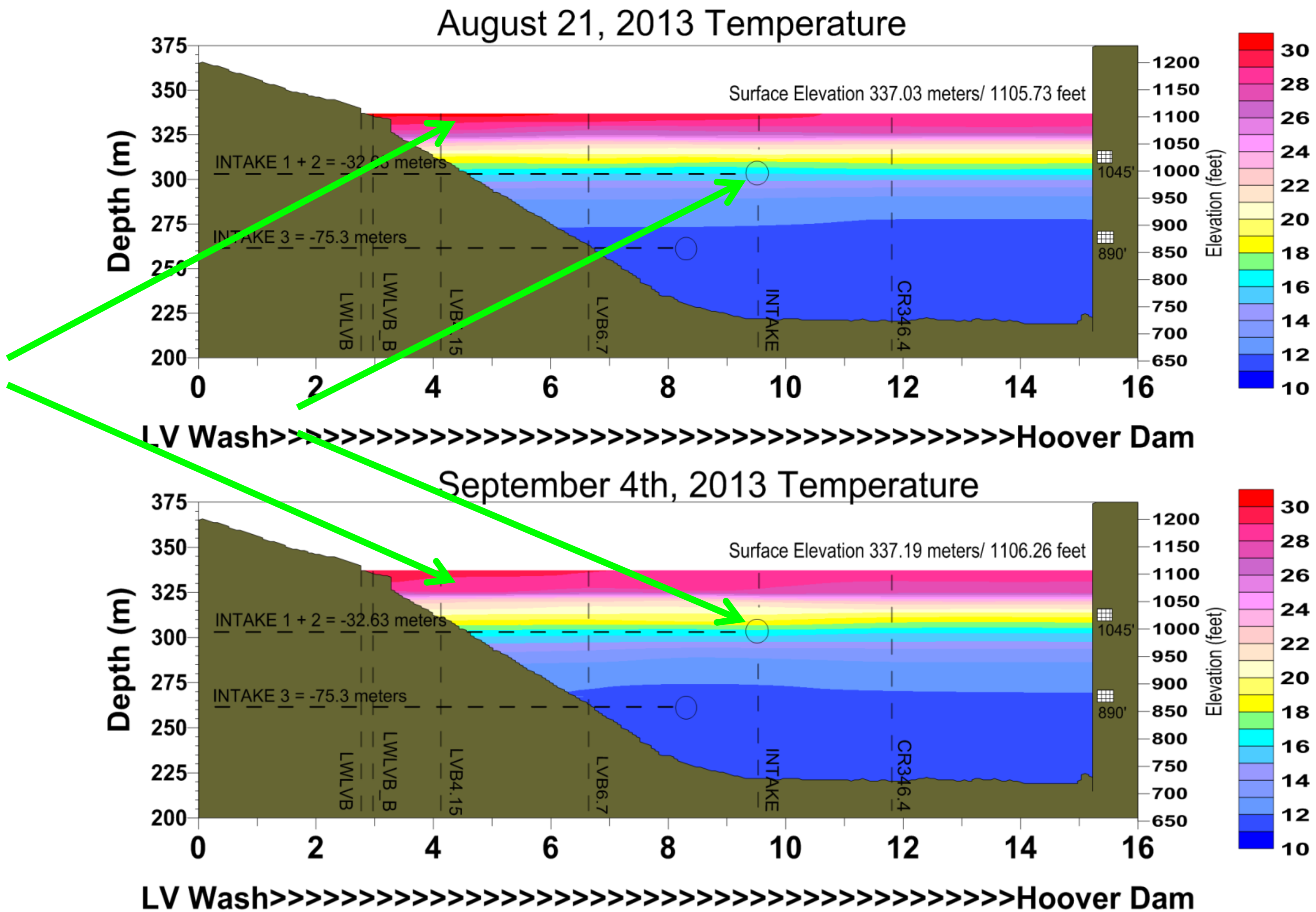


Storm Impacts: Surface

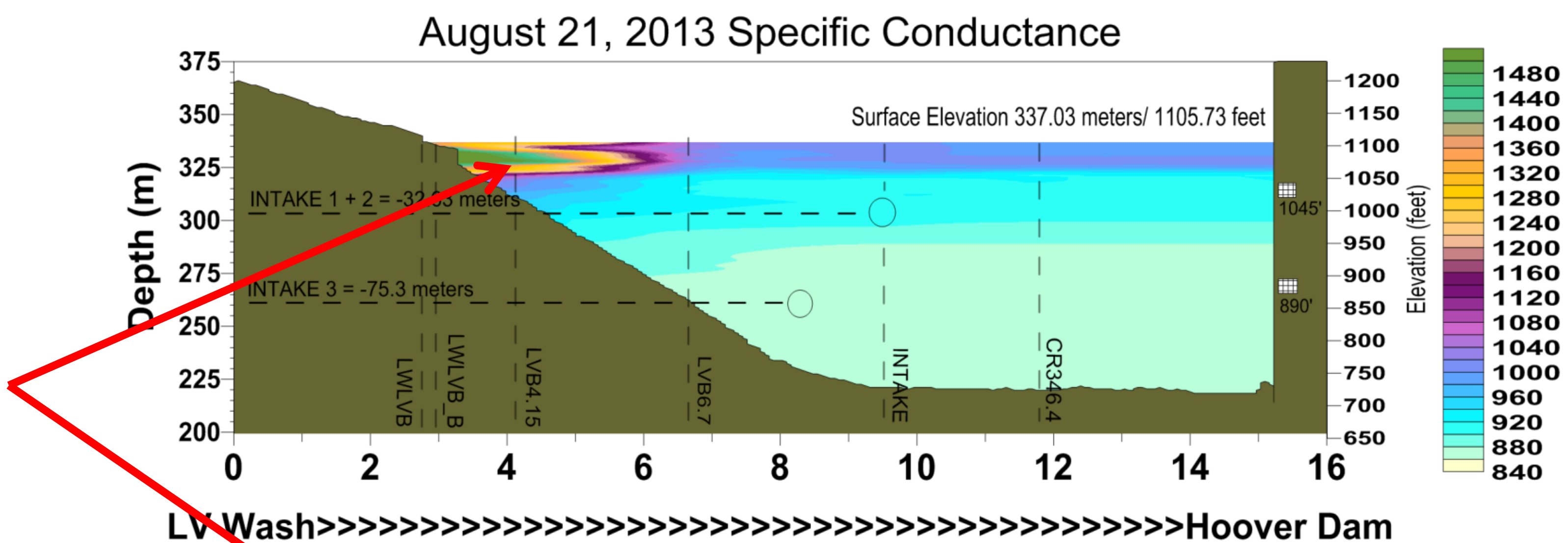

Routine Sampling
Special Sampling
Intakes
2335 m
Google earth

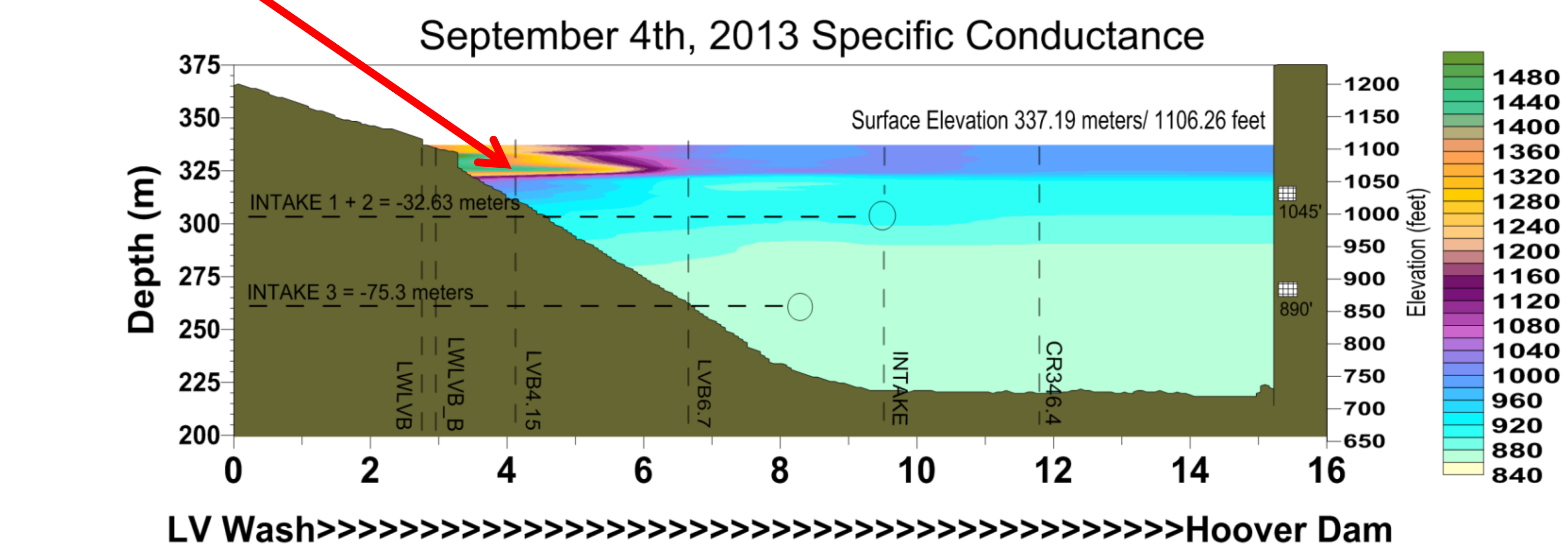

2335 m
Google earth

Temperature

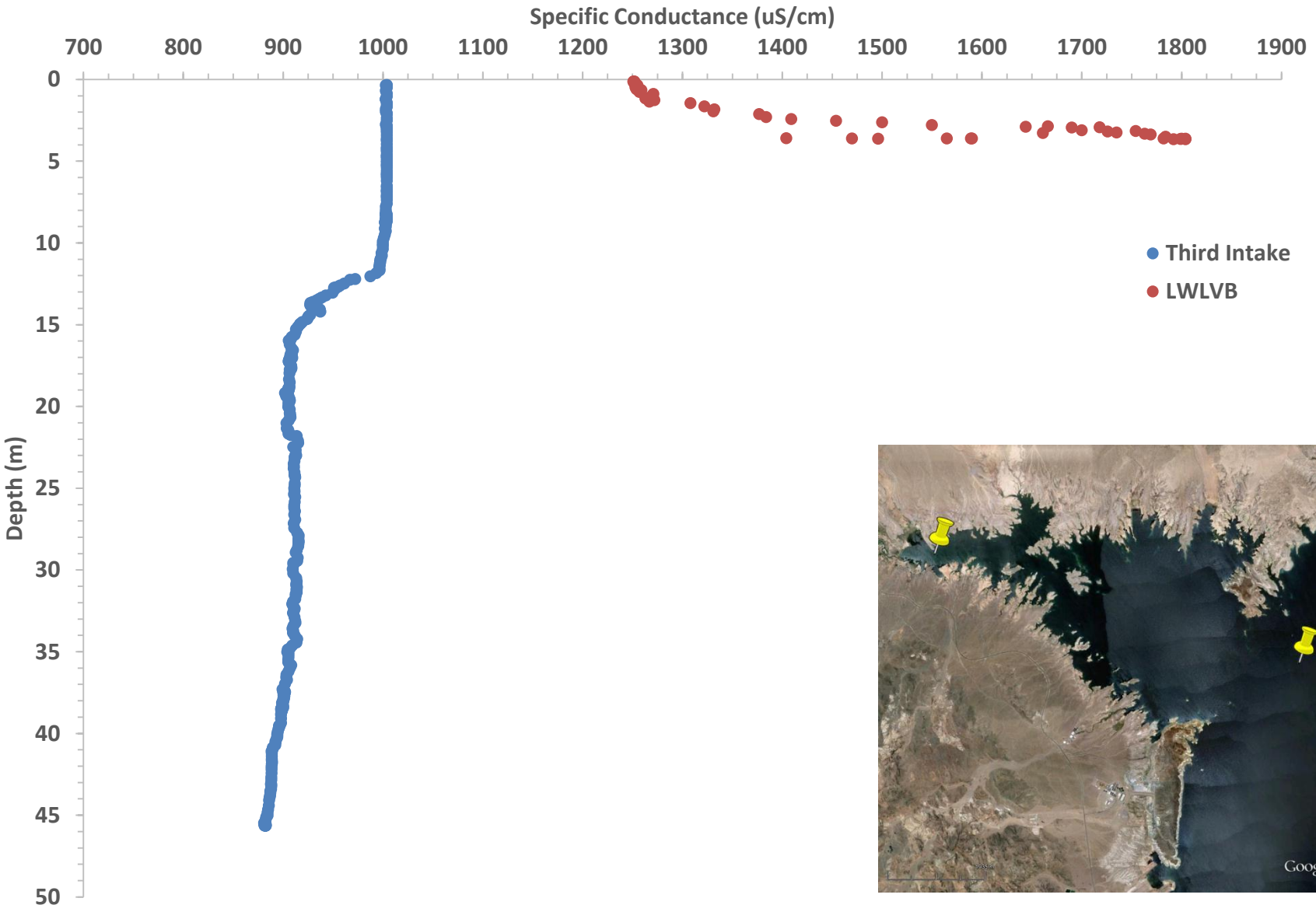


Specific Conductance

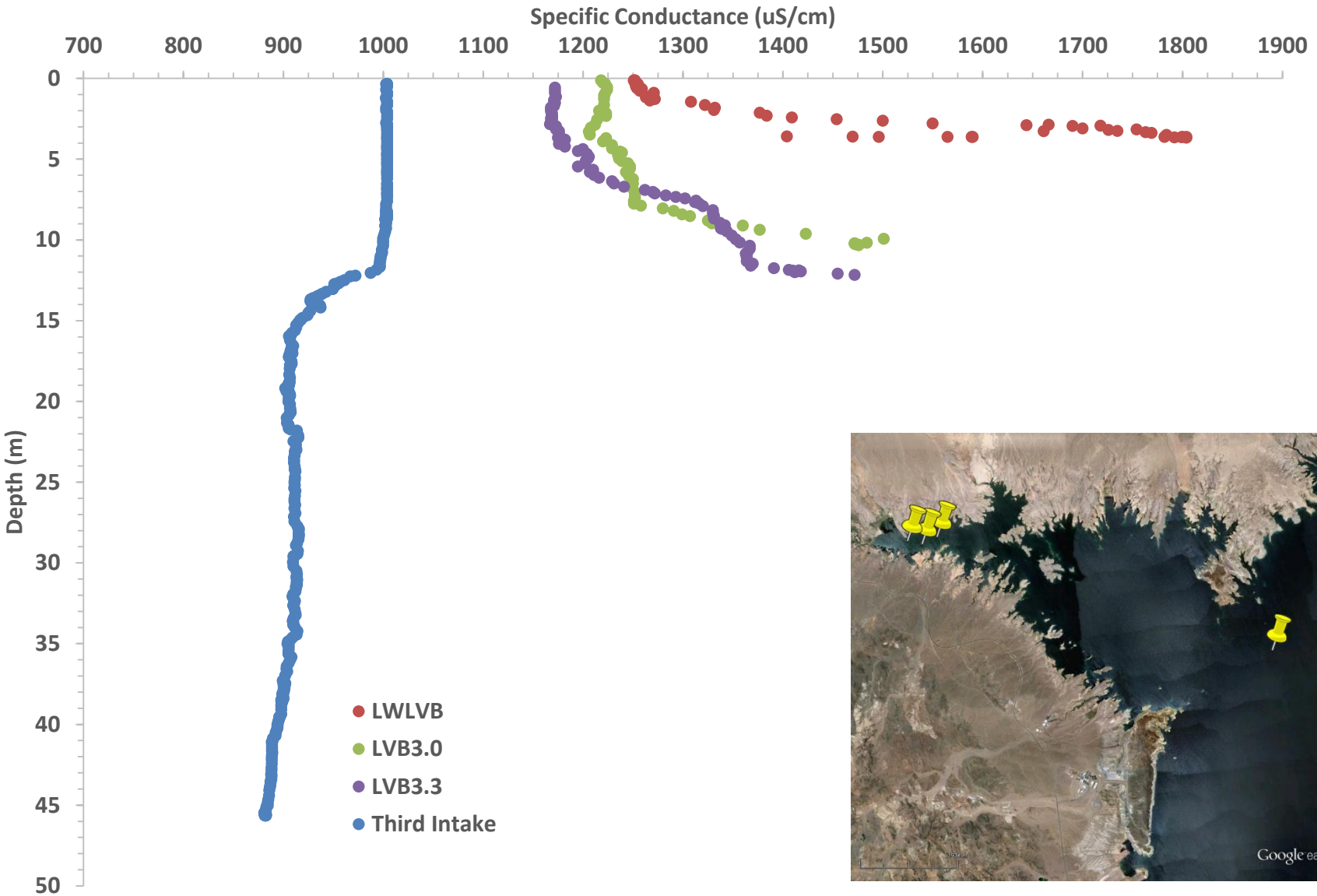




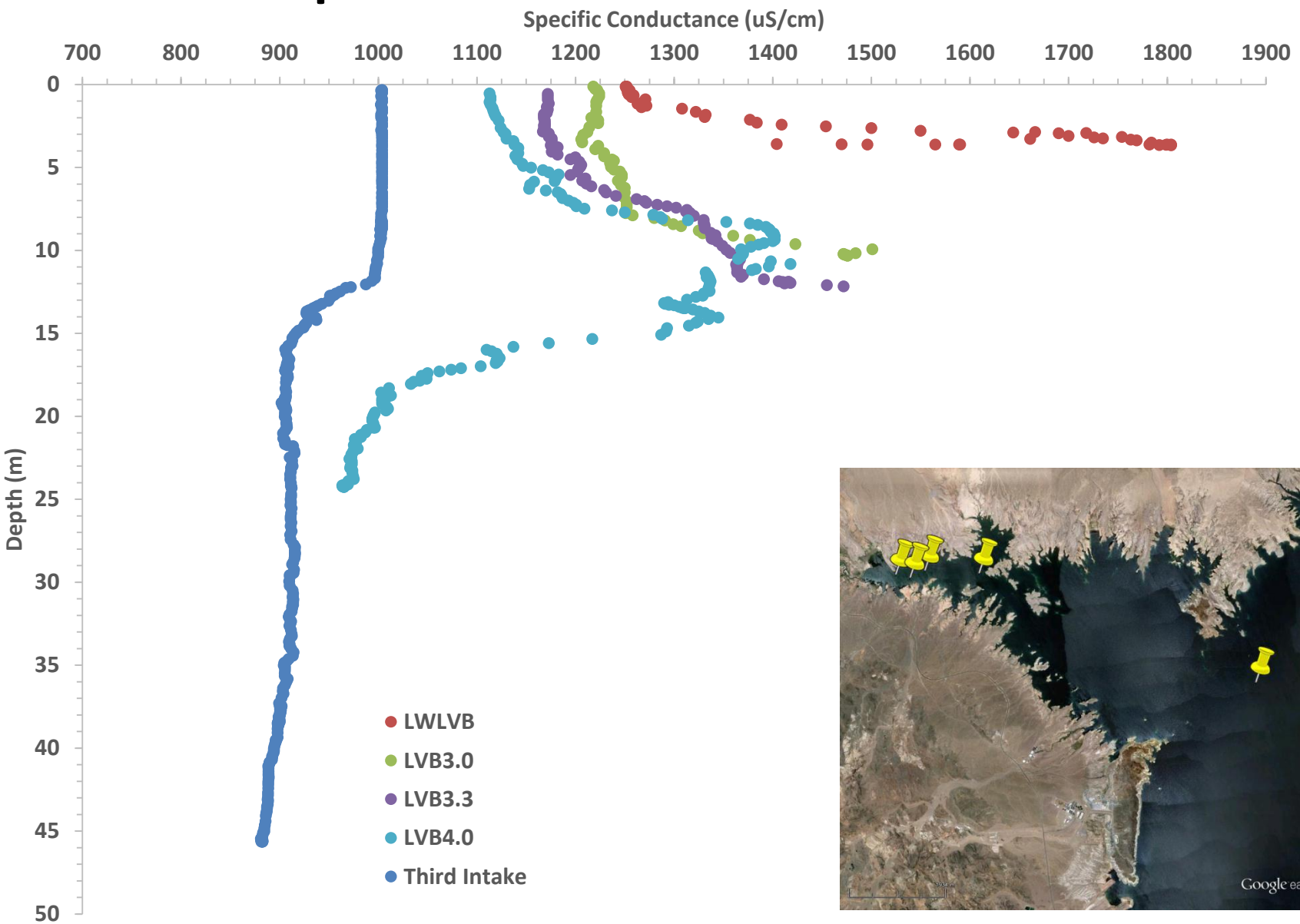
Specific Conductance



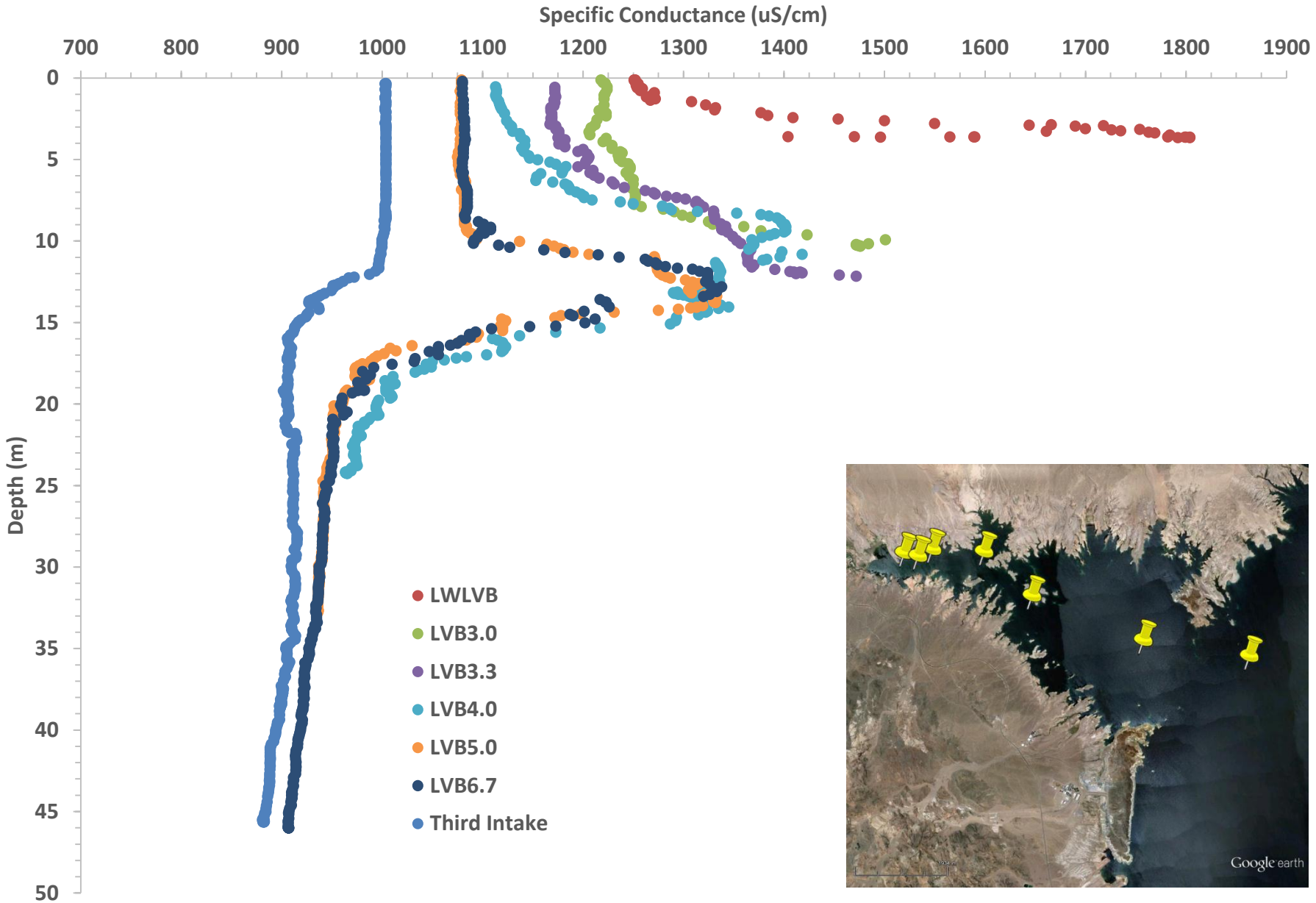
Specific Conductance



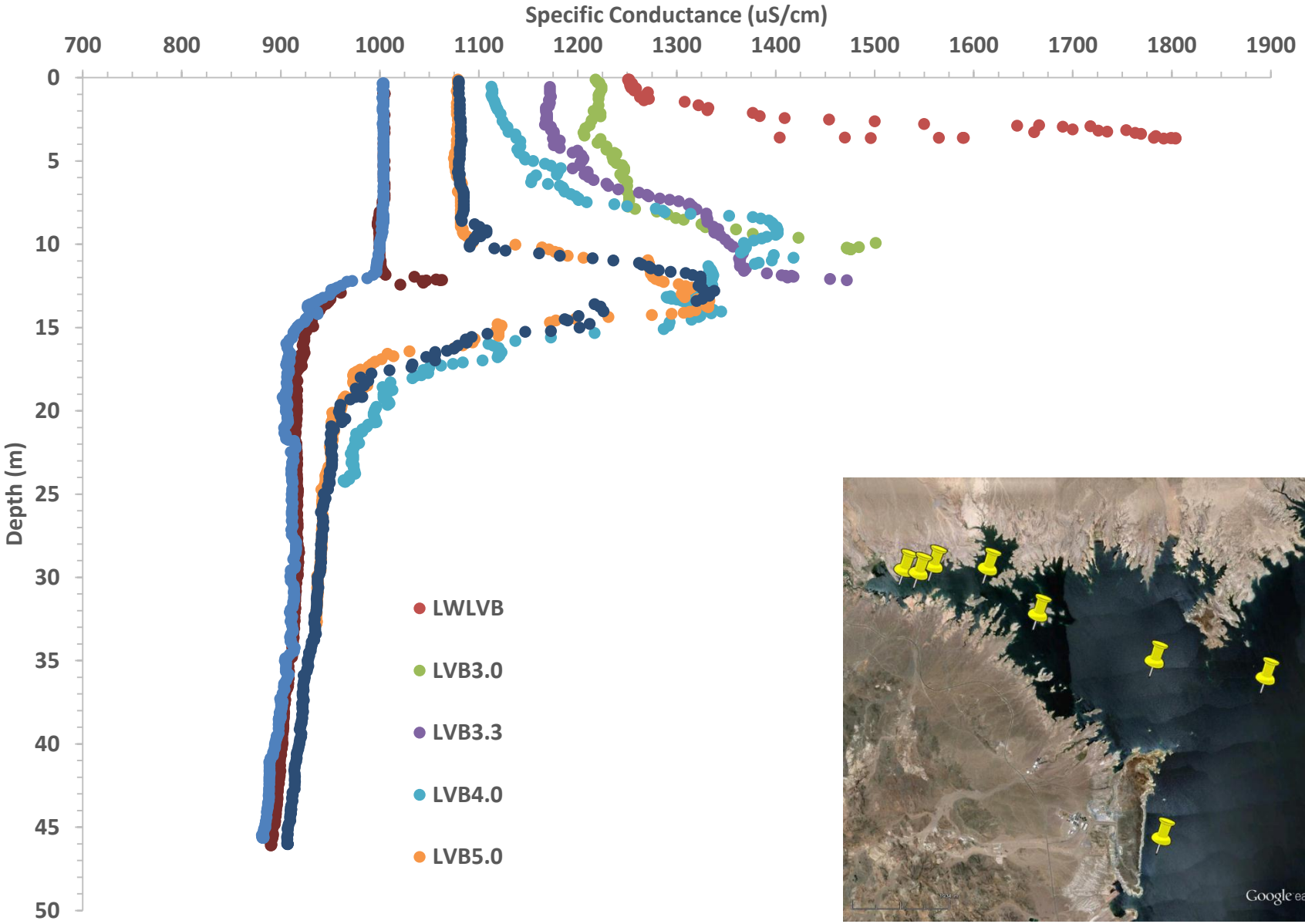
Specific Conductance



Specific Conductance



Specific Conductance



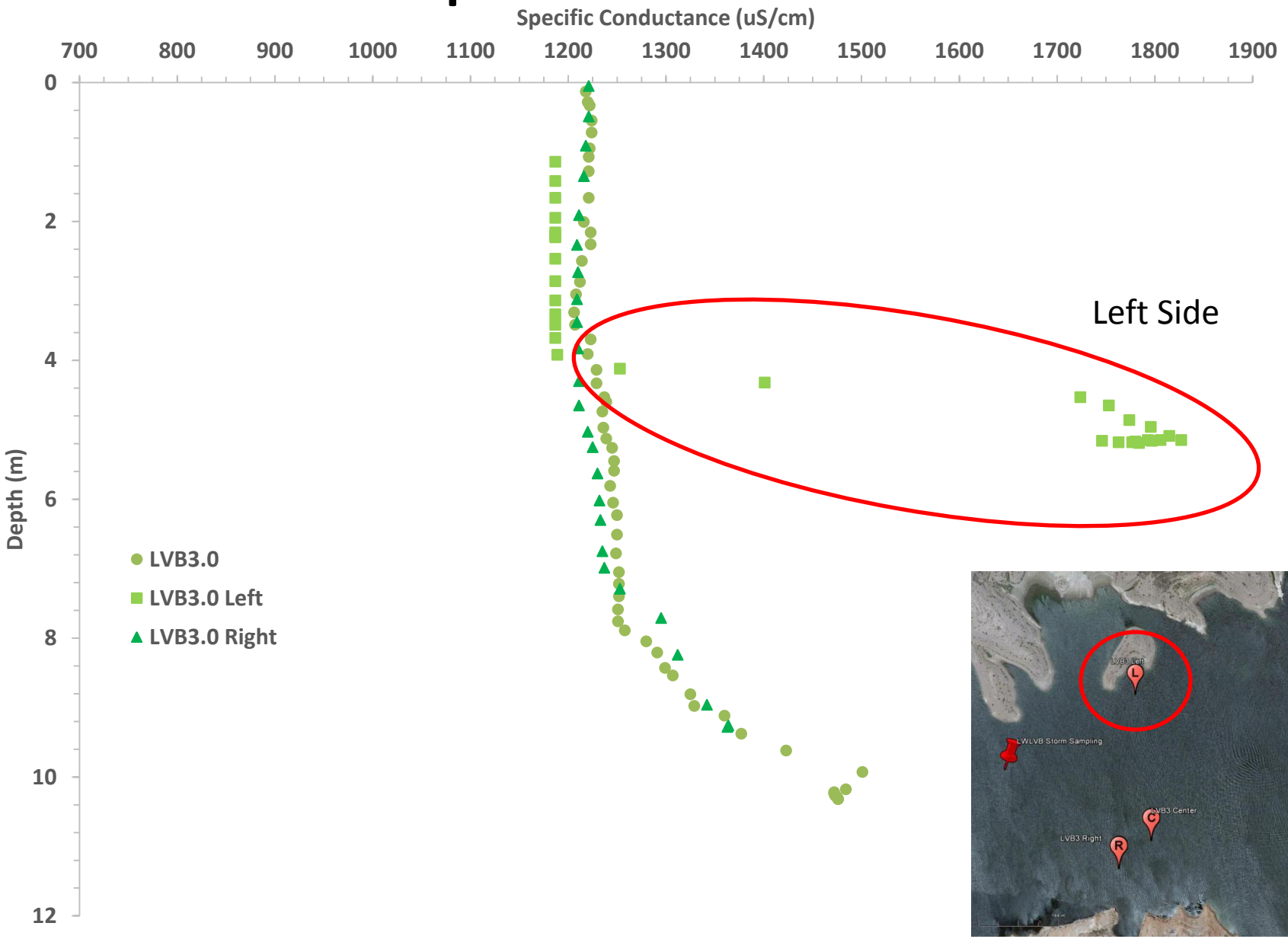
Specific Conductance

- The storm flows entered Las Vegas Bay as an underflow for the first ~0.5 miles
- The inflow then transitioned to an interflow by 1.2 miles into the bay
- The interflow persists to Boulder Basin
  - Visible at Intake 1 and 2
  - Not apparent at Intake 3

Lateral Specific Conductance

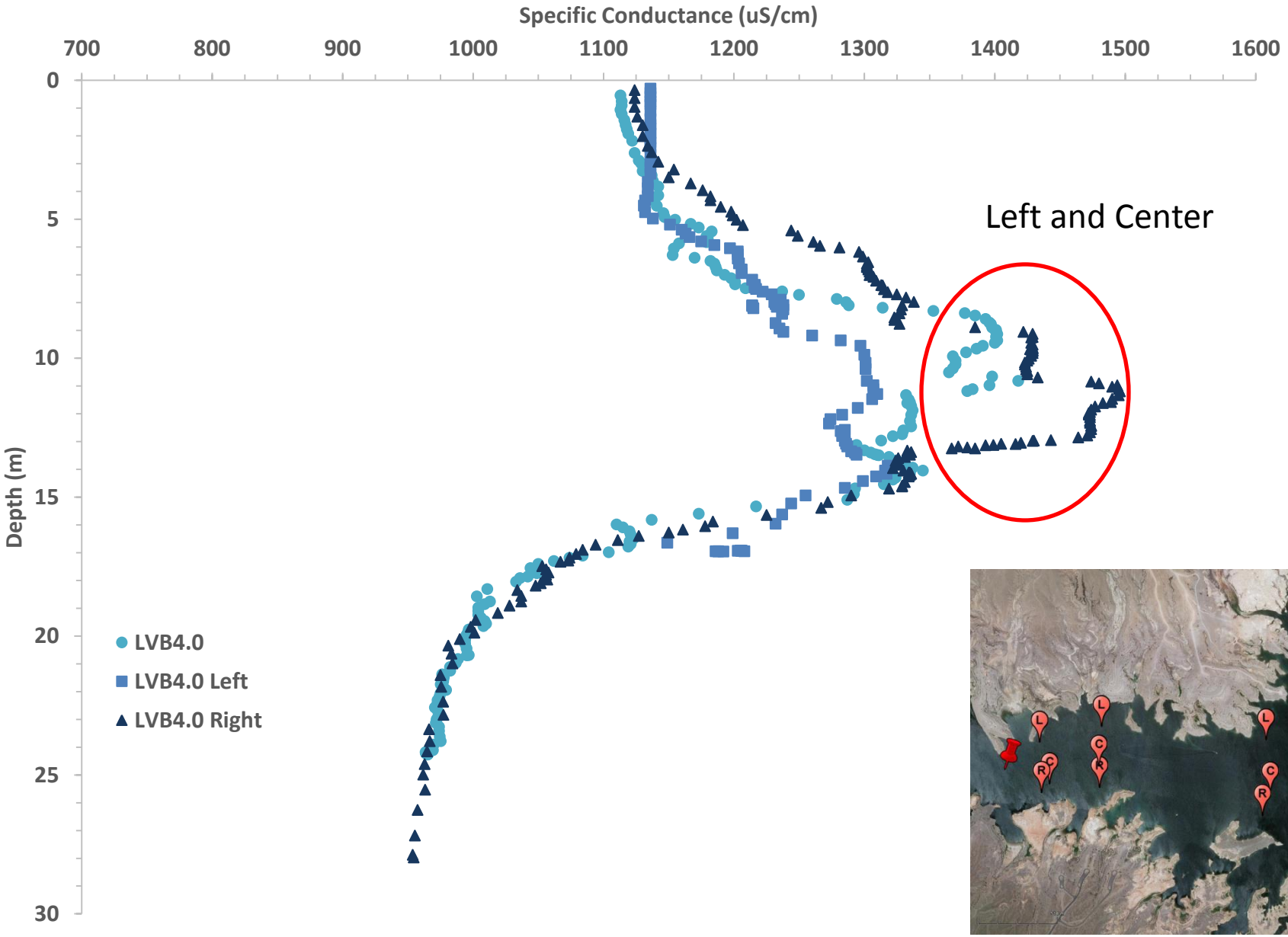
- How did the water travel across the width of Las Vegas Bay?

Lateral Specific Conductance

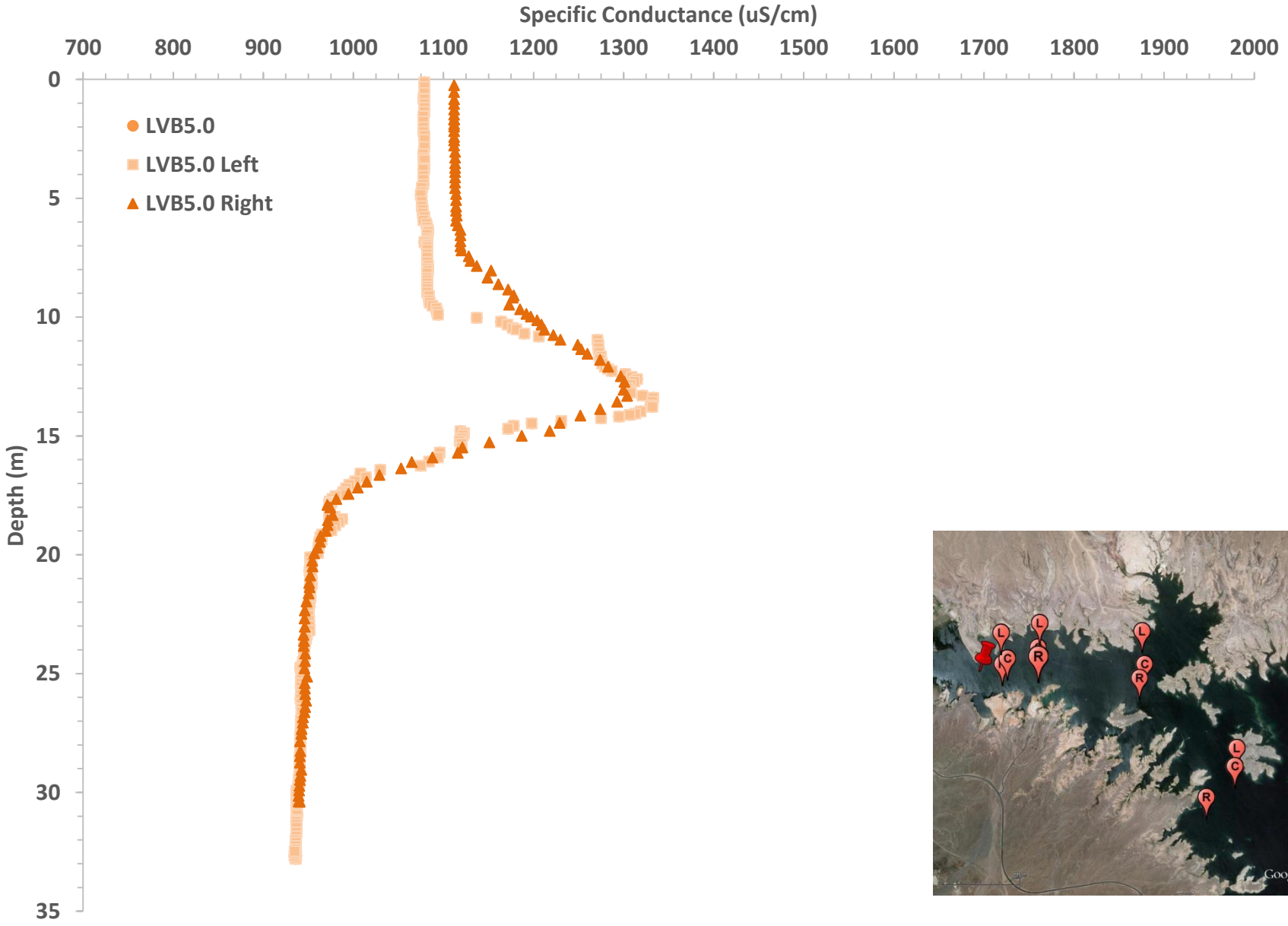


Lateral Specific Conductance

Lateral Specific Conductance



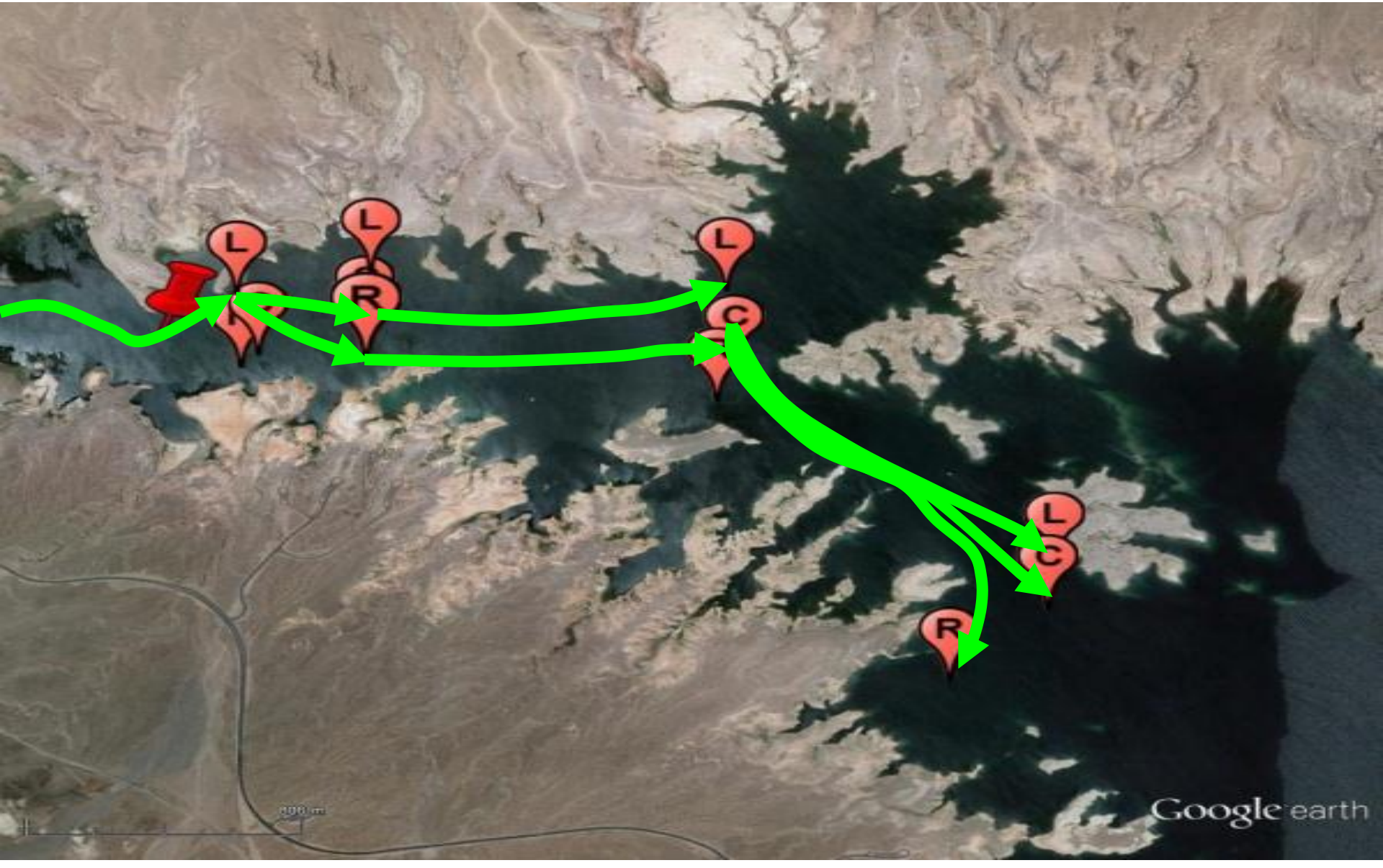
Lateral Specific Conductance



Lateral Specific Conductance

- How did the water travel across the width of Las Vegas Bay?
  - It moved from left to right
    - Was more “common” along Northern Shoreline
  - It did not follow the old river channel
  - It moved in ways that might not be predicted by surface features

Where did the Water Travel?



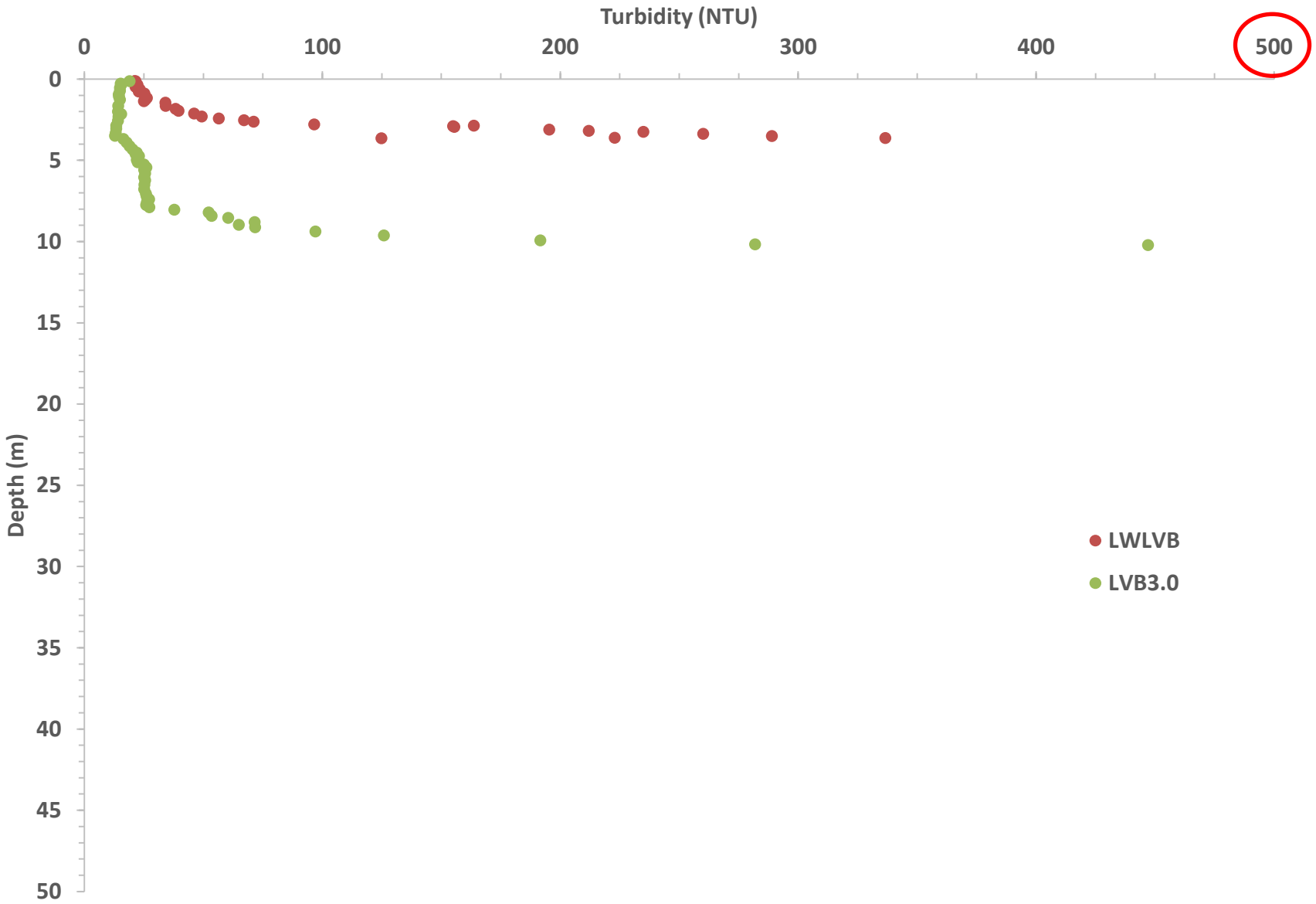
Where did the Water Travel?

Turbidity

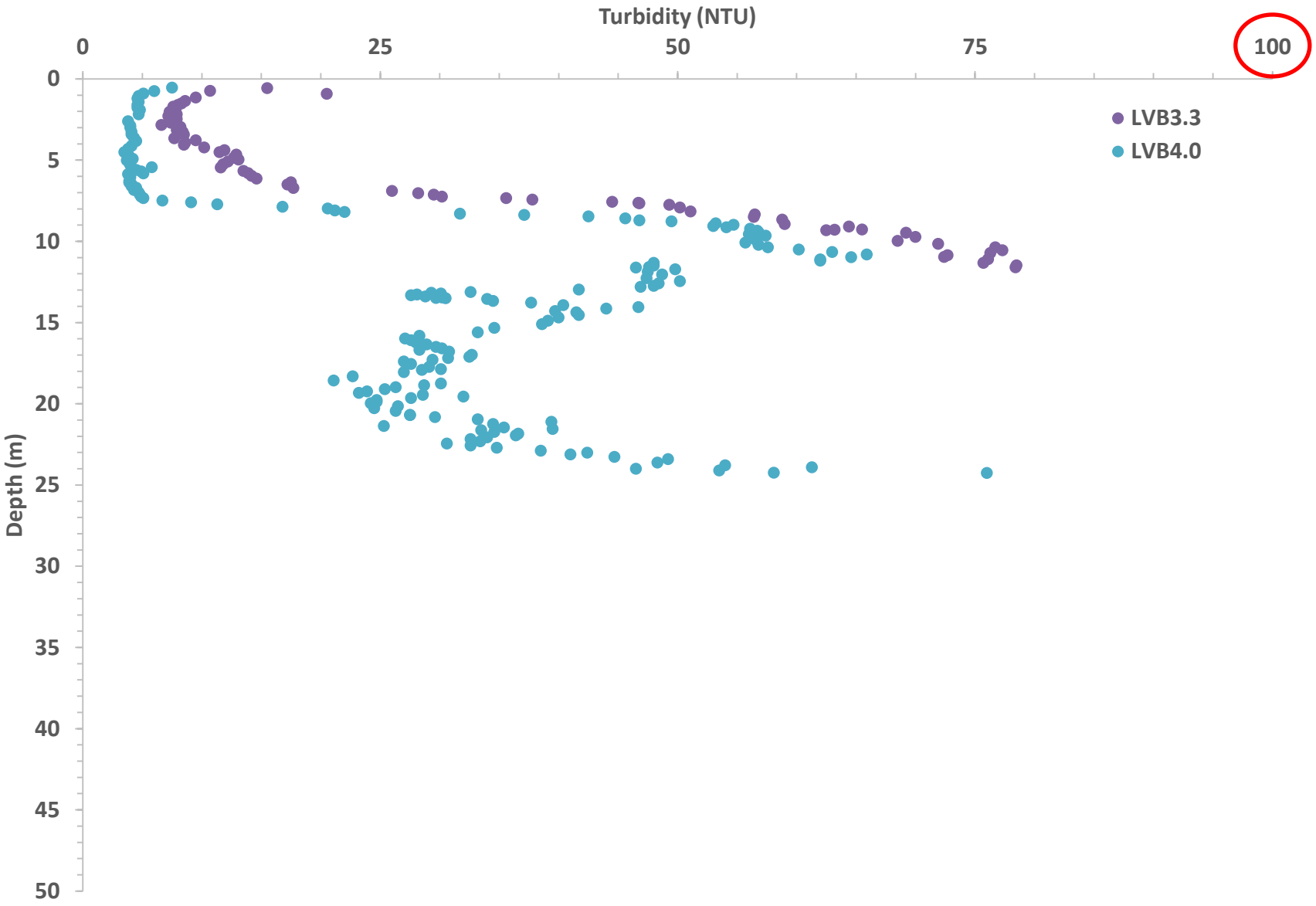
- W


1.85e
27-Aug-2013
11:19
1.85m
27-Aug-2013
11:19
1.85h
27-Aug-2013
11:19

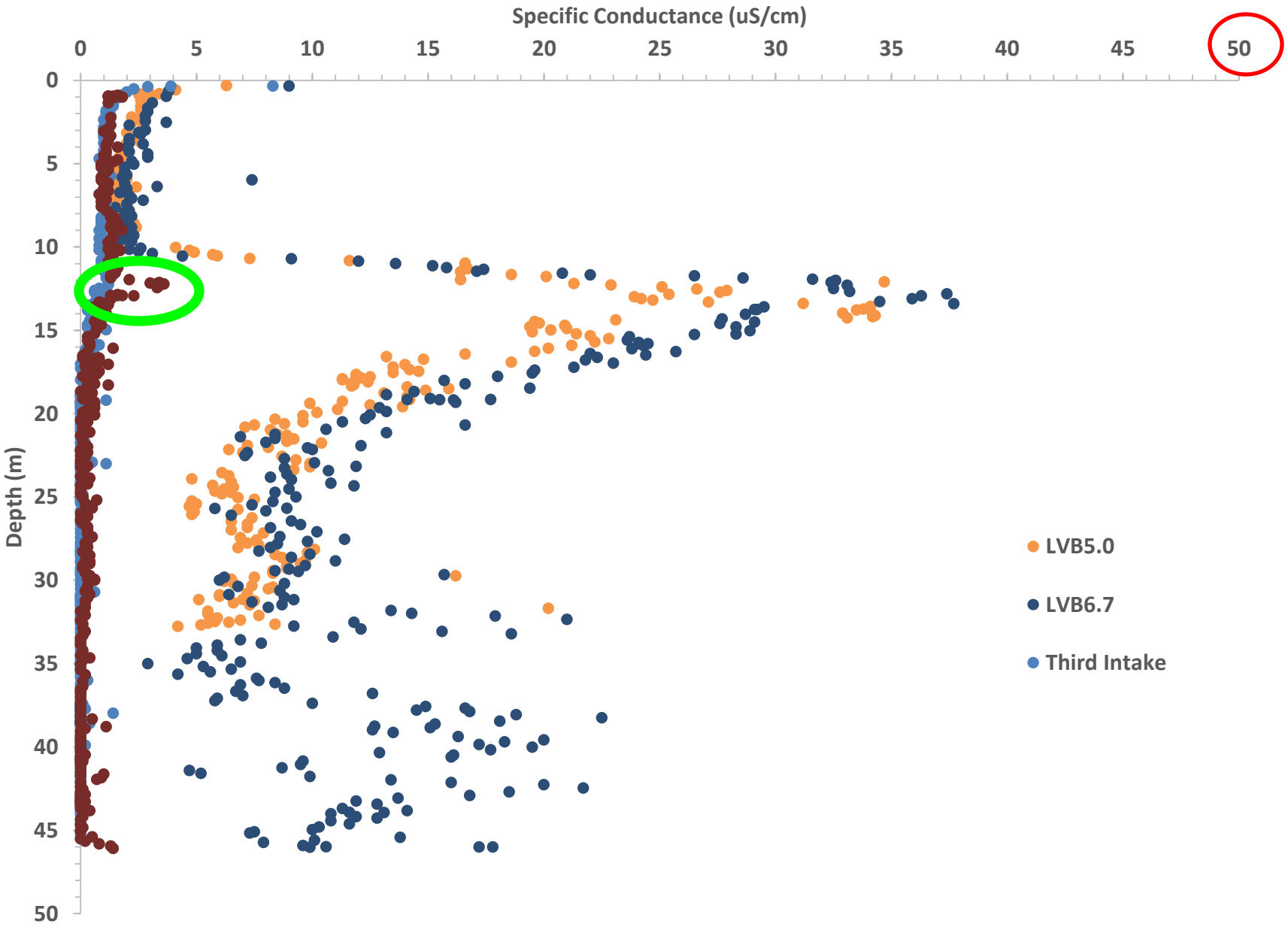
Turbidity


Turbidity (NTU)
0
100
200
300
400
500
Depth (m)
0
5
10
15
20
25
30
35
40
45
50
LWLVB
LVB3.0

Turbidity


Turbidity (NTU)
0
25
50
75
100
Depth (m)
0
5
10
15
20
25
30
35
40
45
50
LVB3.3
LVB4.0

Turbidity


Specific Conductance (uS/cm)
0
5
10
15
20
25
30
35
40
45
50
Depth (m)
0
5
10
15
20
25
30
35
40
45
50
LVB5.0
LVB6.7
Third Intake

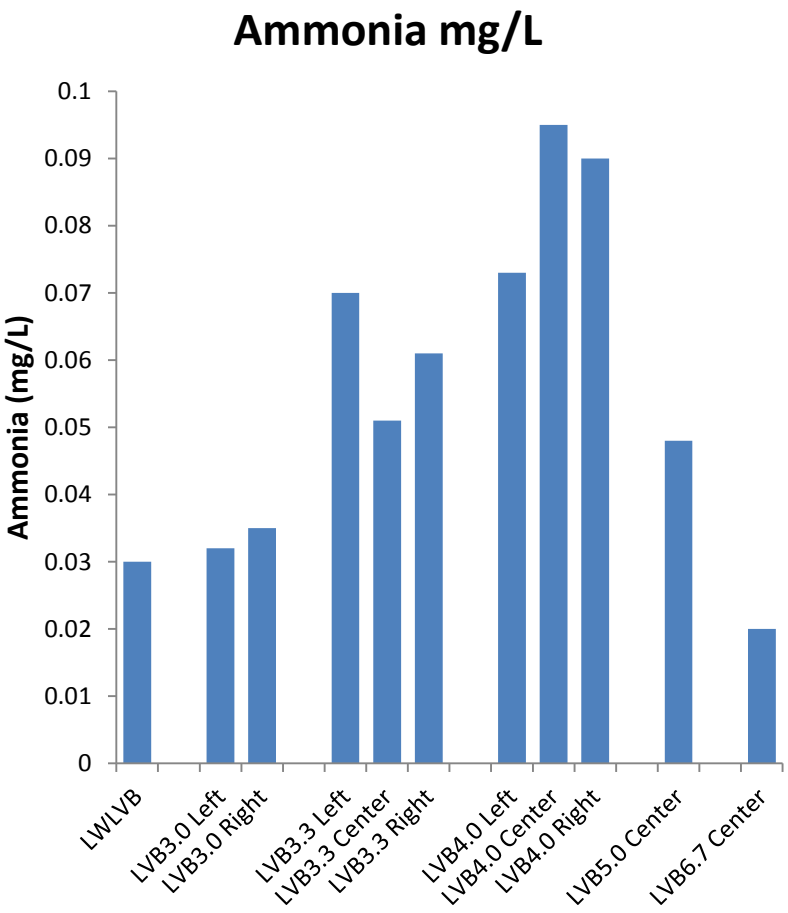
Turbidity

- Generally followed the flow patterns determined by specific conductance
  - Underflow and Interflow
- ~3 days after the storm there was still a significant signature
- There was significant turbidity below the interflow as particles continued to settle
- A very small turbidity signature could be seen at the Intake location

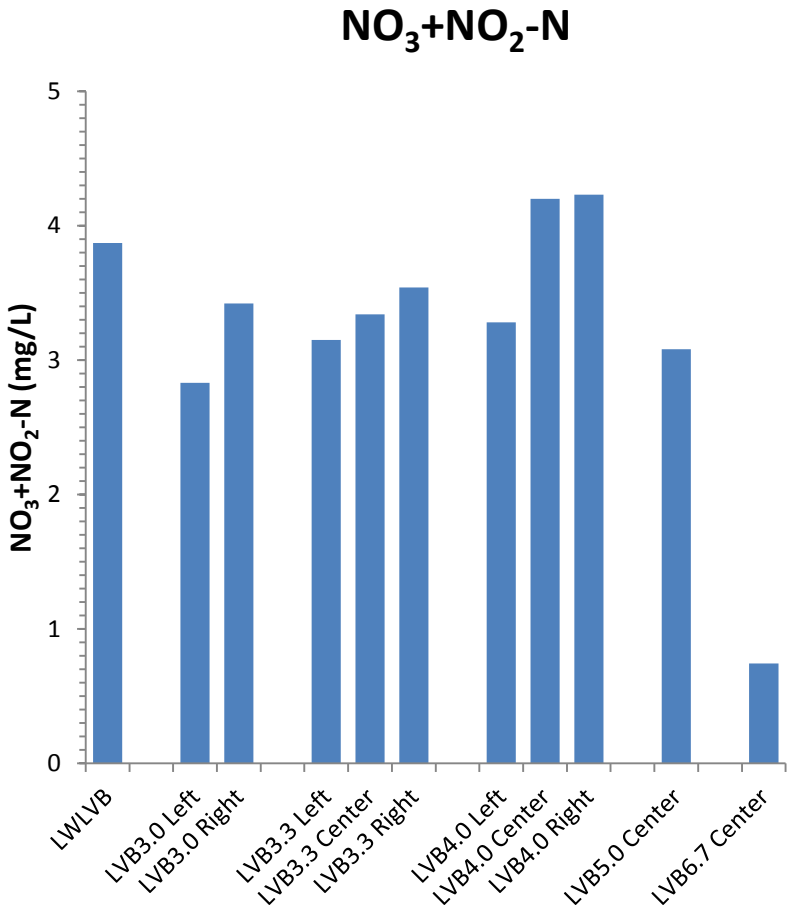
Nutrients

- Getting to something we have great concerns about
  - We know from previous slides that the storm flow entered as an underflow and transitioned to an interflow
  - Did the nutrients follow the water?
    - Can we tell?
- Look at lateral and depth patterns

Lateral Nitrogen

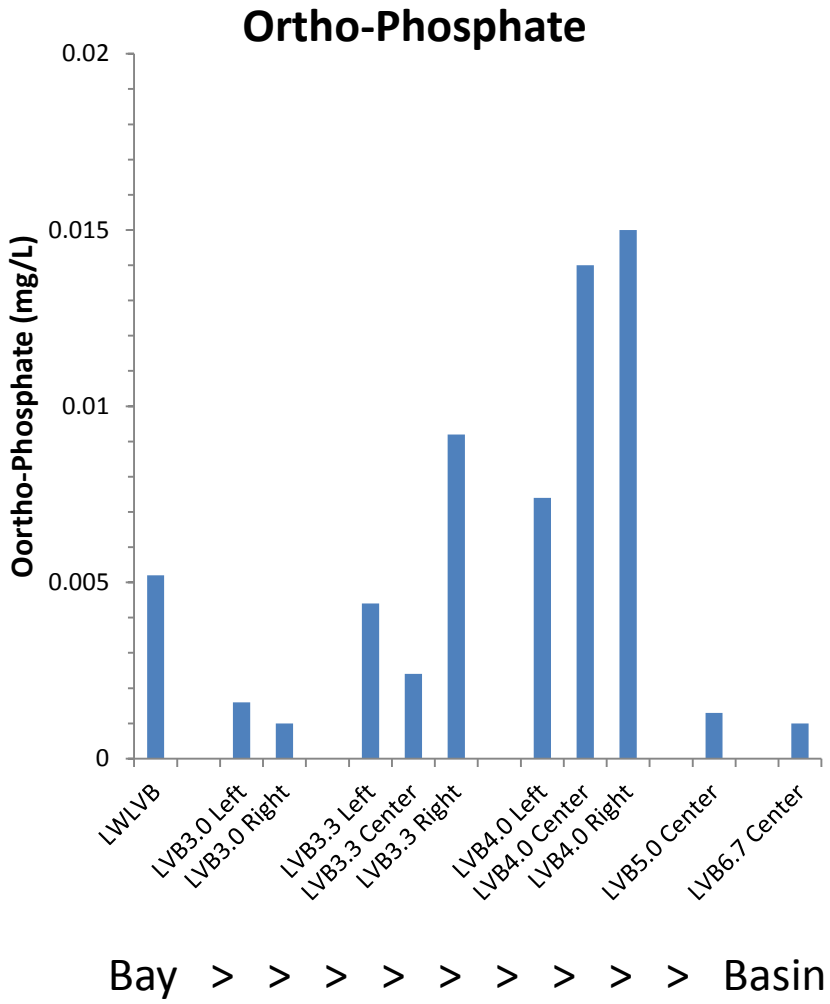


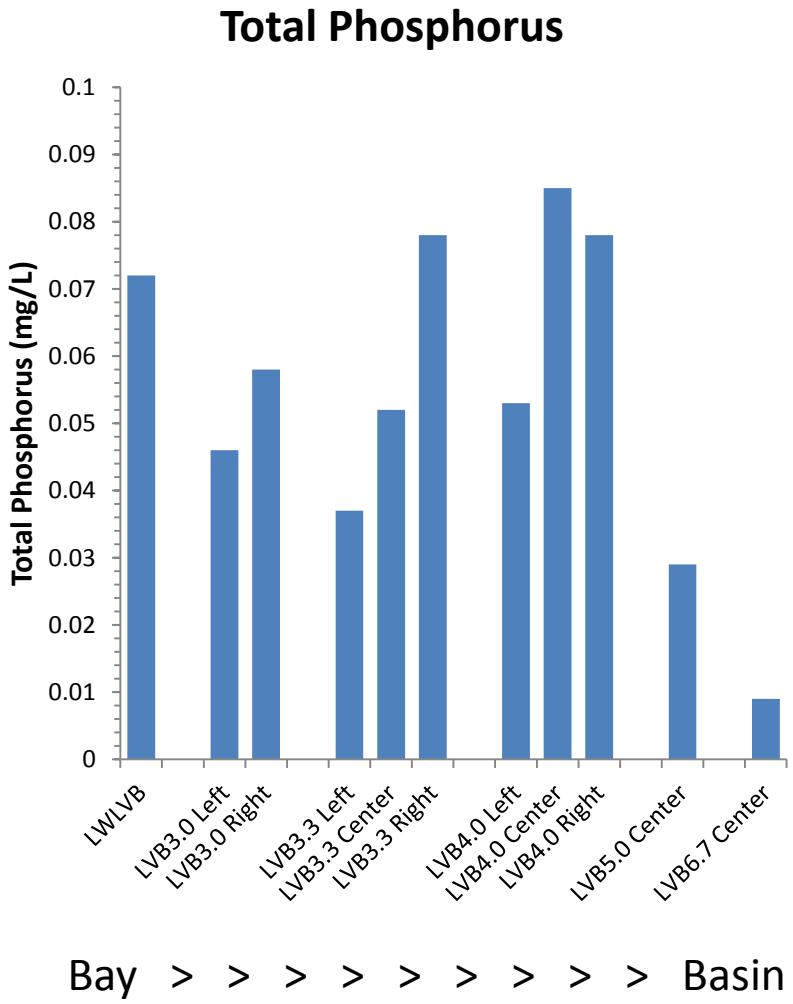
Bay > > > > > > > > > Basin



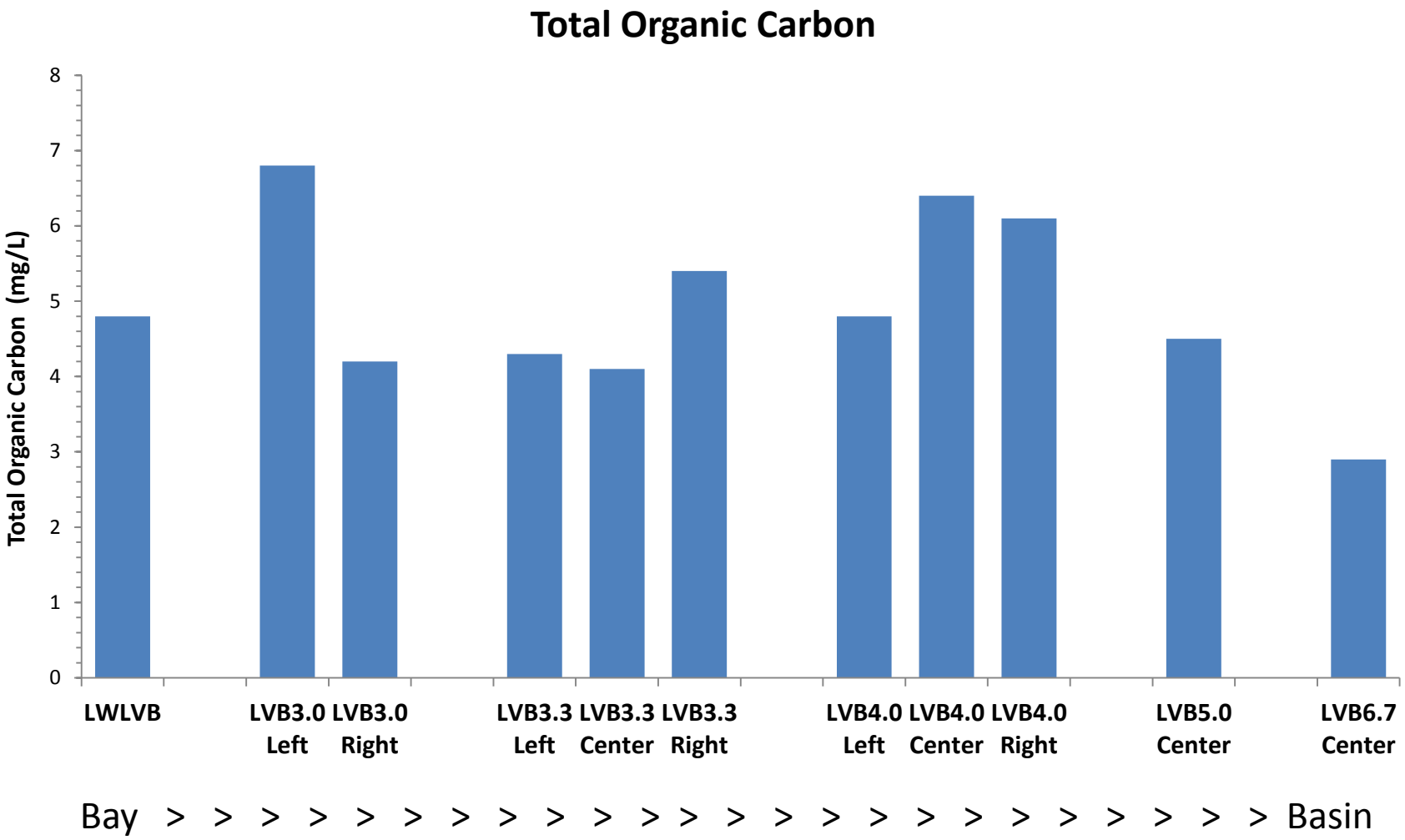
Bay > > > > > > > > > Basin

Lateral Phosphorus





Lateral TOC


Total Organic Carbon
Total Organic Carbon (mg/L)
0
1
2
3
4
5
6
7
8
LWLVB
LVB3.0 Left
LVB3.0 Right
LVB3.3 Left
LVB3.3 Center
LVB3.3 Right
LVB4.0 Left
LVB4.0 Center
LVB4.0 Right
LVB5.0 Center
LVB6.7 Center
Bay > Basin

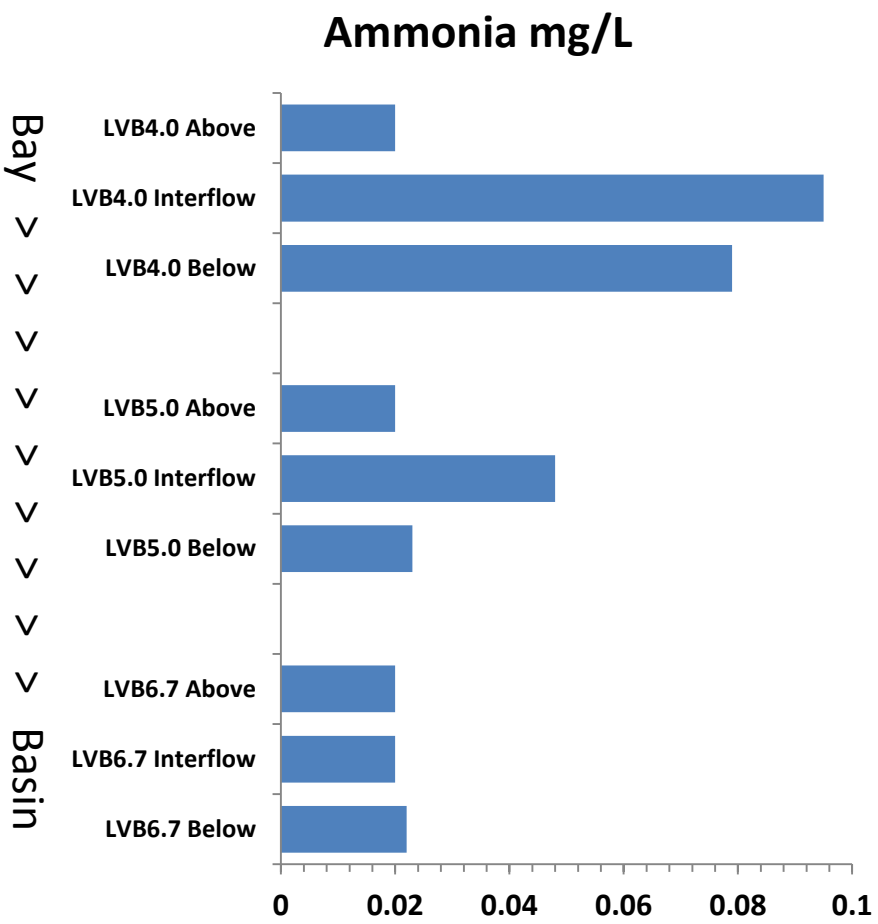
Lateral Nutrients

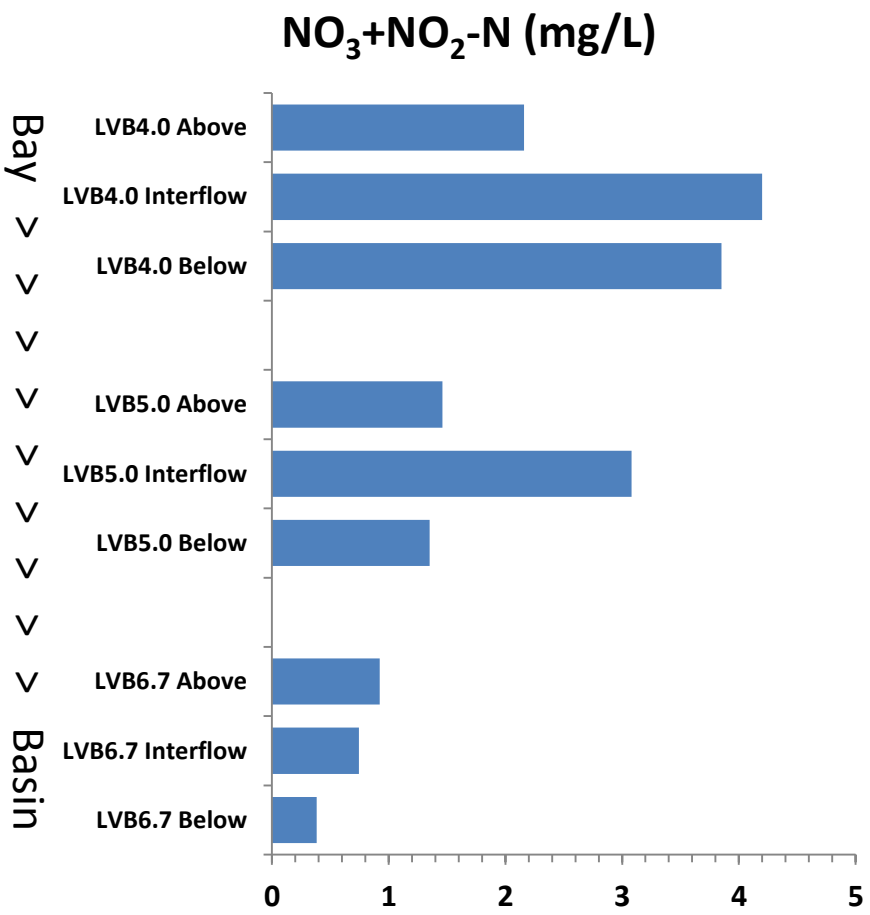
- Storm flow seems to have reached LVB4.0 (~1.25 miles from Delta) in 3 days
- Strong signatures from ammonia and ortho-phosphorus time timing
- Strong signatures for lateral placement from all parameters
  - Generally followed pattern revealed in conductivity data (as well as could be expected)

Nutrient Depth Patterns

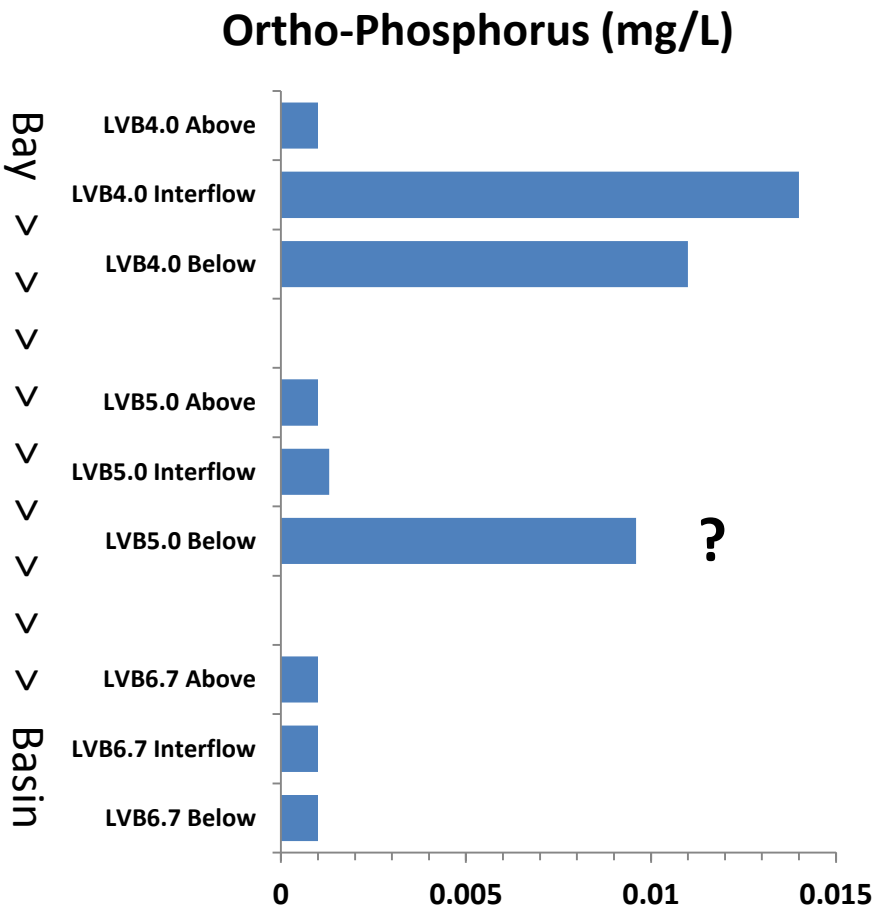
- For the interflow portions of the storm flow we sought to identify how the nutrients were moving up or down in the water column
  - Diffusion: up or down
  - Settling: particles headed down
- If there is significant downward flux we can continue to have reasonable confidence that storms entering Las Vegas Bay away from the surface will not provide significant nutrients to the epilimnetic algae

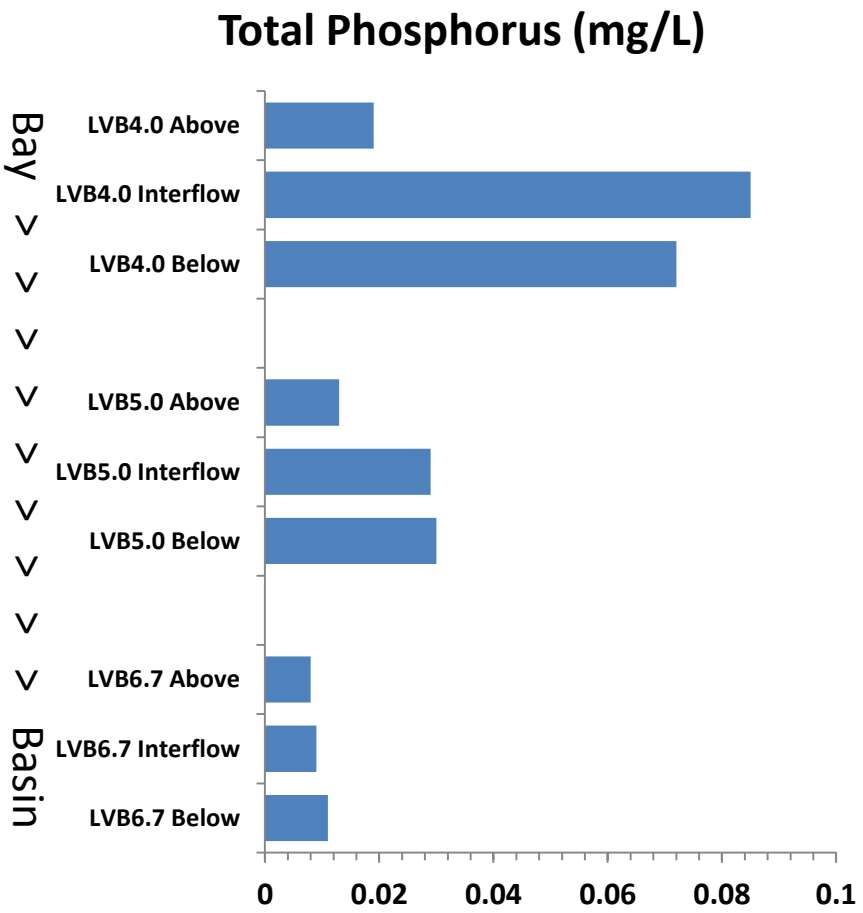
Nitrogen - Depth



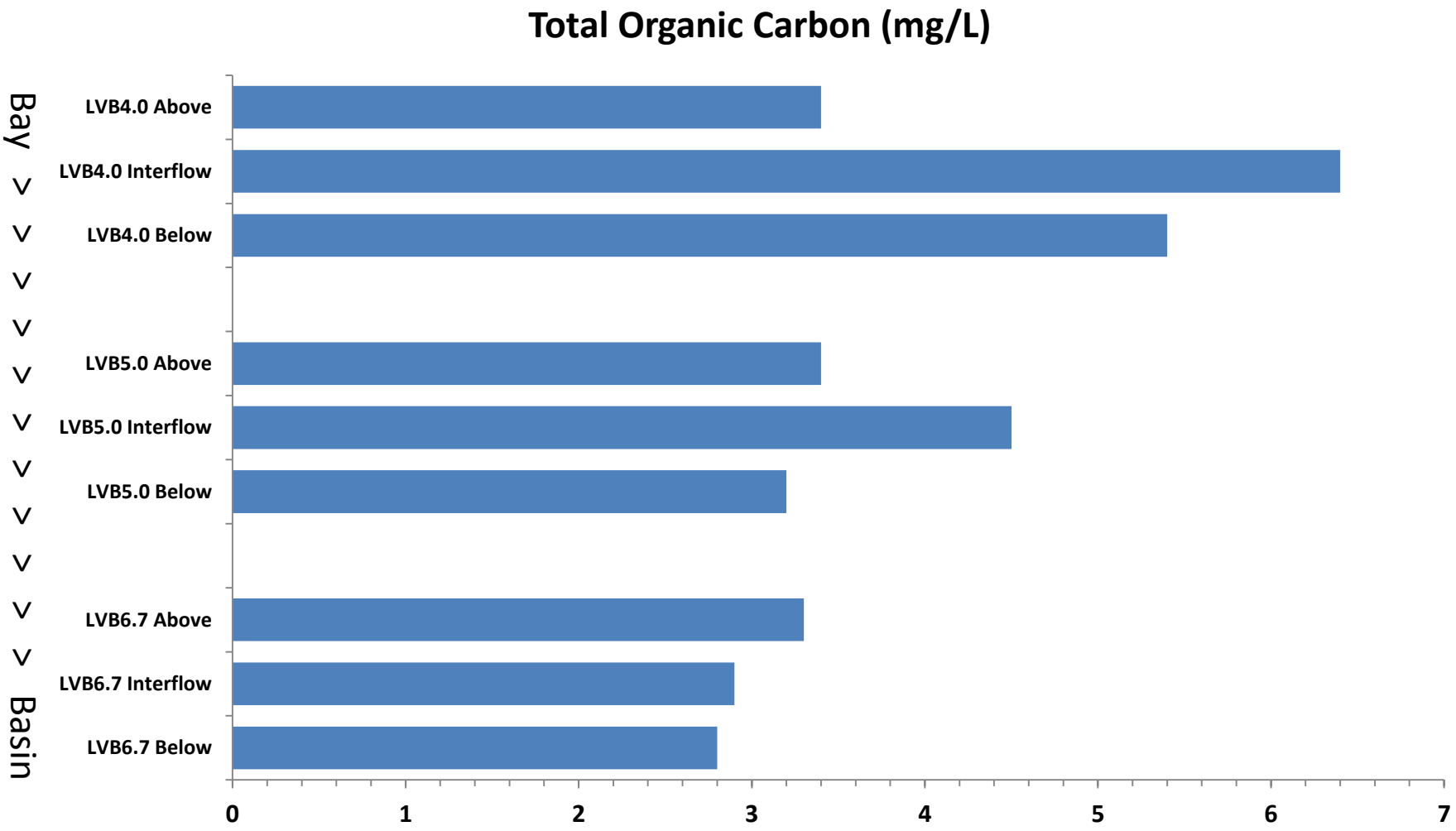


Phosphorus - Depth





TOC - Depth


Total Organic Carbon (mg/L)
Bay
Basin
LVB4.0 Above
LVB4.0 Interflow
LVB4.0 Below
LVB5.0 Above
LVB5.0 Interflow
LVB5.0 Below
LVB6.7 Above
LVB6.7 Interflow
LVB6.7 Below
0
1
2
3
4
5
6
7

Nutrient Depth Patterns

- Diffusion was lower than our ability to detect it
  - Probably not significant enough to provide nutrients to the epilimnion for a storm of this magnitude/source
- In general the patterns were similar to turbidity; higher concentrations in the interflow but elevated below the interflow
  - Stuff is settling out
    - Dissolved nutrients are being released to the water from settling material
- LVB6.7 seems to reflect non-storm patterns
  - Very slightly higher concentrations in the epilimnion

Conclusions

- We are as smart as we think we are:
  - Storm water entered the bottom/middle of the water column
  - Storm water spread laterally from the river channel
    - We cannot really predict this, but do we need to?
  - The storm water had moved into Las Vegas Bay, but not entirely out of it, in 3 days
  - Conductivity is a good tracer for bulk flow
    - Probably not great for nutrient concentrations, turbidity might be better
  - Increases in nutrient concentrations were correlated with the interflow and water below it
- We still have the September storm to analyze
  - Smaller storm, sampling closer to the event, confounded by monsoon season

Cooperators

- Interagency Sampling Group
  - Joint Sampling event in September provided guidance for sampling
- City of Las Vegas
  - Sampling the August 26th storm (this data)
- USGS
  - Sampling of September storm
- SNWA Regional Water Quality and Laboratory